Hydrogen in Model Combustor

GOALS

The relationship between fuel composition and combustor performance will be established using the following methods:

- •Emission Test
- •High resolution gas analyzer for low emission
- •Acoustic Measurement Test
- •Piezoelectric pressure transducer
- •OH Radical Imaging
- •Intensified CCD
- •Velocity Field Test
- •PIV(Particle Image Velocimetry)
- •Lean Blow Off/Stability

Our final goal is to evaluate a possibility for application to gas turbine generator with next generation fuels.

RESULTS

The emission result below shows NOx emission data when Hythane is used as the pilot fuel. With an increased percentage of Hydrogen, NOx emission in exhaust gas is reduced. Interestingly, increasing the % of hydrogen in the pilot actually reduces the stability of the reaction. This illustrates that care must be taken relative to use of the hydrogen for piloting. The coupling of the aerodynamics and heat release must be considered in determining how best to introduce hydrogen into the combustion system.

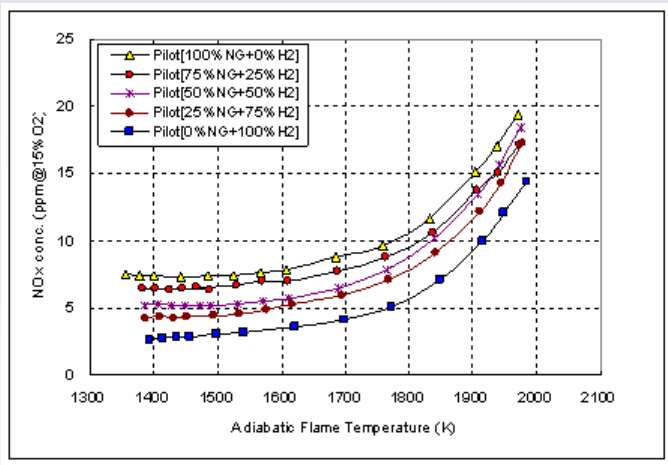

Figure 1. NOx Reduction by Hythane as Pilot Fuel

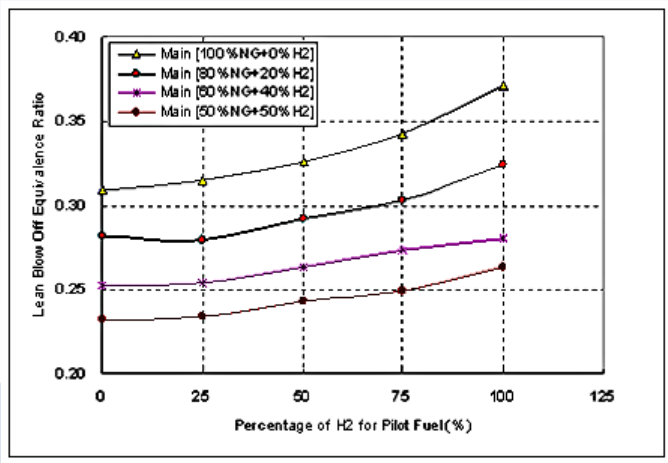

Figure 2. Lean Blow Off Characteristics

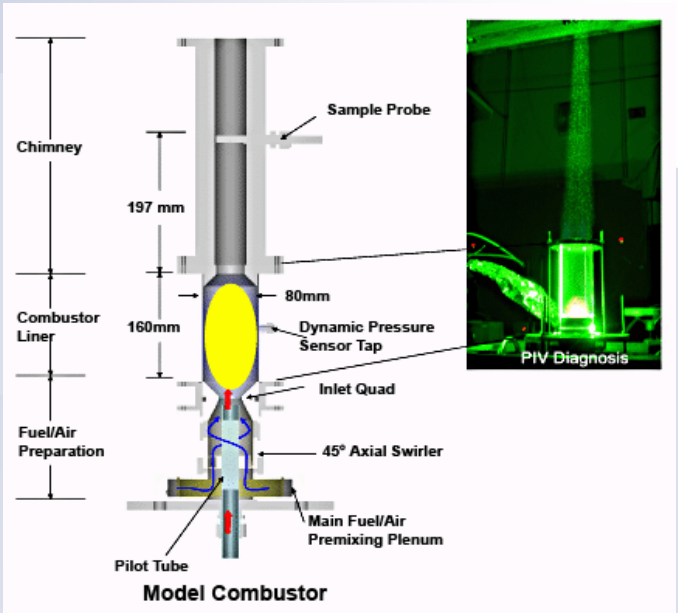

Figure 3. Model Combustor

FUTURE WORK

Introduction of hydrogen into main fuel circuit will also be explored to determine the relative performance when compared with natural gas and injection through the pilot circuit. Additional tests are planned which will utilized fuel blends comprised of CO, H2, and diluents to represent fuels generated by gasification.
The results obtained will give guidance to combustor designers relative to strategies for operating low emission combustors on these next generation fuels.

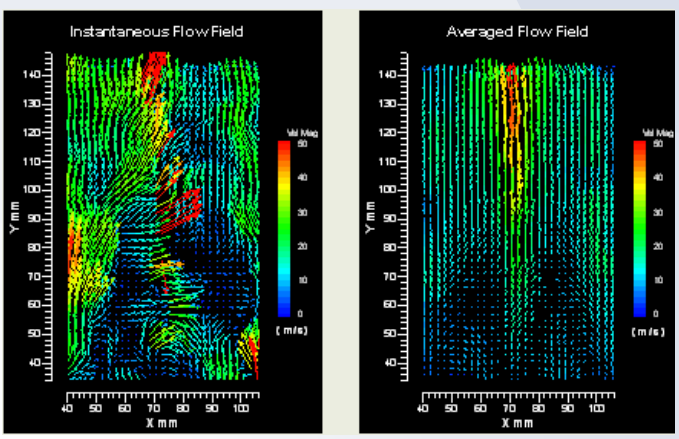

Figure 4. Diagnosis Region : Center Line Cross Section
Fuel Type : Hythane
Main 60vol%N.G.+40vol%H2 / Pilot Fuel 100vol%H2
Adiabatic Temperature=1575K

PERSONNEL

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